VII. 6.

FRAZER'S THEORIES:

EMBRACING

THE CAUSE OF THE

ATTRACTION OF GRAVITY,

AND

COHESIVE ATTRACTION,

TOGETHER WITH

AN EXPLANATION

OF THE

PRINCIPLES OF ELECTRICITY.

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PREFACE.

The publication of this little book has been delayed, from time to time, through diffidence of the author, and would be delayed still longer, were it not for the urgent request of many who have become partially acquainted with his theory and wish to understand it thoroughly. There being no better method by which they can be gratified, (the author having ceased travelling and lecturing on the subject,) he ardently wishes (and almost without hope,) that they may not be as badly disappointed in their anticipations concerning this work as the little Philosopher was when he cut open his father's bellows in search of the wind, and found for his trouble the displeasure of his parent.

The author does not flatter himself that his theory will stand the test of critics, in every respect; but merely desires that it may be the means of directing the attention of some more able theorists to the subject, and that they may improve upon it, from time to time, until something grows out of it calculated,

at least, to strengthen and cultivate the mind. Progression is one of the important laws of nature;—the more we know the more we want to know, and the more we are capable of knowing.

The object of this work is more to inspire the reader with a desire to understand the science of Electricity, than to gratify a desire of that kind. The author believes that in this way the reader may be profited more than by all the knowledge he could impart concerning the science; for it is yet in its infancy and should be fed with the nourishing and wholesome food of desire.

INTRODUCTION.

We are surrounded by a mysterious, subtle, potent and all-pervading principle, generally called electricity or galvanism, to which we are indebted for our lives; indeed the whole animal kingdom would cease to breathe the breath of life were it not for the exhilerating influence of this principle. The vegetable kingdom is also dependent upon it. Yes, we may safely say that the Deity uses it in the creation of those immutable laws whereby our earth in due season is clothed in verdant green. Nor is this the only instance in which the great I Am has used electricity. When we come to investigate those natural laws by which our Maker governs all material matter, we find that electricity is the main-spring by which they are brought into action. The combined efforts of every other agent could not so much as hold two of the smallest particles of matter together. No, there is nothing under heaven capable of creating the slightest attraction save electricity. It is therefore the cause of cohesive attraction, without which the material of which the massive earth is made could not be held together; hence there would be no earth: the particles of which it is made would be left free to move in every direction throughout the universe. The power that holds the particles of matter together in large or small masses, is called cohesive attraction, the cause and nature of which we purpose giving in another lecture. Again; electricity no doubt is used by the Deity in making those particles of matter, at least it is thought so by many modern electricians. We believe that the Deity made

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To what are we indebted for our lives and surrounded by?—What else is indebted to this principle for their lives?—For what purpose does the Deity use it?—What is electricity the main-spring of?—What is it that the combined efforts of every other agent could not do?—It is therefore the cause of what?—What is it that the materials of the earth could not be held together without?—If they were not held together, what would be the result?—Why would there be no earth?—What is thought to be used by the Deity in making particles of matter?

them out of something, and why not out of electricity? We know that he uses it in keeping everything in existence, for in the attempt to extricate the electricity from a substance, we destroy the substance itself, that is, it becomes something else; for instance, you take some of the electricity out of zinc, it becomes oxide of zinc. Therefore it is reasonable to believe that the Deity breathed electricity into existence before he made anything else, hence it is necessary to study the science of electricity before we can thoroughly comprehend the nature of any material substance, or even appreciate the Maker's goodness, wisdom and power in creating and bestowing upon the human family countless millions of temporal blessings, which so long lay, and many of which, no doubt, are still lying in an unimproved state. Were we fully in the possession of the advantages that might be obtained by having a thorough acquaintance with them, who could tell how much oftener our hearts would be elevated in gratitude to the Giver of all good. We have no doubt but that with all the knowledge we can get in this life concerning these things, they will yet remain a great mystery to us; not that our minds are incapable of comprehending them had they proper training, but that the facilities for strengthening the mind of man are not sufficiently good to produce a capability of comprehension in so short a time as is allotted him. We have no doubt but what the mind is created in the image of the Deity, and consequently capable of an infinity of strength through the proper use of means; and just in proportion to the use of means are our minds capable of comprehending the advantages of an acquaintance with the laws of nature, or *vice versa;* and who can pretend to deny that this is the Deity's mer-

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What is it he uses in keeping these particles of matter in existence after they are made?—Why do we know it?—What is reasonable to believe?—What is it necessary to study before we can thoroughly comprehend the nature of any material substance?—What is calculated to elevate our hearts in gratitude to the Giver of all good?—What is it we have no doubt of?—Why so?—What else is it that we have no doubt of?—What is the comprehension of our minds dependent upon, and what is the result of this?—Do you suppose the Deity designed it for this purpose?

ciful design, in order that man may not see and feel his wants and imperfections until they are partially supplied. He knew, through his infinite wisdom, that a knowledge of our wants would terminate in despair to poor, weak-minded man; and should we not admire such kindness as this in the Deity? Oh! there is goodness and wisdom herein manifested that we cannot contemplate without adoration.

Can we have that pure and undefiled gratitude for what God has done for us, without searching out his marvellous works and ways? Adoration thus produced, is calculated and designed by the Deity to constitute a great portion of our happiness in this life, if not in the life to come. We are told that our happiness in the life to come depends upon the preparations we make for it in this life. Would it not be preparing ourselves for happiness of this kind for us to endeavor to live constantly through the economical use of proper means, under the healthful influence of happiness derived from the same source that a great portion of the happiness that is in reserve for us after we have done with time is derived, viz: adoration of God's works? and hence we verily believe, that as the knowledge of God's works is to the happiness produced by adoration in this life, so is the happiness produced by adoration in this life to the happiness produced by adoration in the life to come. All are bound to agree that this is a fair statement of the subject. But some of our readers may think that the compliance with the terms, that is, in using economically proper means to become acquainted with the Deity's handy-works in order to admire them, has something of importance to do with the matter before us. Well, about all that it has to do with our subject, is this: so soon as we commence

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What would a knowledge of our wants be likely to terminate in?—What should we admire?—What is herein manifested that you cannot contemplate?—What is it that we must do in order to have gratitude to the Deity?—What kind of adoration is designed by the Deity to constitute a great portion of our happiness in this life, if not in the life to come?—What does our happiness depend upon?—What would be preparing ourselves for this kind of happiness?

using those means with the proper object in view, and no other, viz: to understand and adore God's works, we will find them, instead of being irksome, (as is only the case when we are actuated by impure motives,) creating in us a desire to understand them, that is accompanied in all cases with a prospect of being realized; and we know that the pursuit of an object with a prospect of realizing it, gives more pleasure than any other employment whatever, and we will, therefore, derive a pleasure from using the means that will compare favorably with any other earthly happiness.

Were we capable of having and realizing an ardent desire of this kind, would it not constitute a happiness that might compare favorably with any in reserve for us in the life to come; but as to this we know nothing, and therefore will leave it for saints to decide upon. But we do really believe that we will all be permitted, through the mercies of God, to realize a desire of this kind fully in the life to come; and no doubt the happiness derived from this source will depend upon our desire to understand these things. Now those desires depend upon the preparations we make here, which preparations are made by becoming acquainted with these things with a view to acquire a desire to understand them.

Perhaps we have said enough on this subject to convince such as were not convinced before, that it is our temporal as well as our spiritual interest, to study the laws of nature; if so, we have accomplished all that we design, except to show the necessity of studying the science of electricity before we can possibly understand the laws of nature, and this, we fear, cannot be done without first learning the science itself, owing to the impossibility of fully appreciating what has or might be said previous to a partial acquaintance with the subject.

What is this desire accompanied with?—What is it we know concerning this pursuit?—What will we derive?—What will this pleasure compare favorably with?—What is it we do really believe?—What will the happiness derived from this source depend upon?—What do those desires depend upon?—How are these preparations made?—Is it our temporal as well as our spiritual interest to study the laws of nature?

SECTION I.

LESSON I.

THEORY OF ELECTRICITY.

There are two theories of electricity—Dr. Franklin's and Dufay's—and it appears from late manifestations, that Dufay's theory is better adapted to the purpose of accounting for the phenomena of a current of electricity as excited by the galvanic battery. Dr. Franklin's theory accounts for most of the phenomena of the old-fashioned electric machine tolerably well, such as was in use cotemporary with him; but we are persuaded that Dufay's theory is the correct one for reasons to be given in their proper places. According to Dufay's theory the electric principle is of two kinds, while Dr. Franklin supposes it to be of but one kind, and that it is necessary in experimenting to have two vessels placed

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How many theories of electricity are there?—Whose theories are they?—Which one appears to be the right one?—What does Dr. Franklin's theory account for tolerably well? According to Dufay's theory how many kinds of electricity are there?—How many kinds according to Dr. Franklin's theory?—What is necessary in experimenting according to Dr. Franklin's theory?—What does the electricity do when one of the vessels are filled and the other is empty, according to his theory?

close to each other, one of which must be filled with electricity, while the other should have little as possible in it, so that the electricity may pass in search of any equilibrium, experimenting as it passes, which it will do if the vessels be very near each other. For instance, you hold a sheet of paper between the two vessels, as the electricity passes you will find that it makes a hole in the paper. Now it is evident that the electricity passes through the paper from one vessel to the other, and that in this way the hole is made in the paper; but we are not prepared to believe that it would have power enough to make the hole by merely passing in search of an equilibrium, for observation proves that electricity exerts very little power in finding an equilibrium, and if we examine that hole, we find that it is made by something passing through it from each side. Now this could not be the case if the electricity merely passed from one vessel to the other, for then the paper would be perforated only from the side near the vessel that had the most electricity in it. Dr. Franklin's theory scarcely accounted for a hole being made

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What does the electricity do in reality when a piece of paper is held between the two vessels at the time it passes from one vessel to the other?—What is it that we are not prepared to believe concerning this?—What does observation prove?—What do we find on examining the hole?—If the electricity merely passed from one vessel to the other, what would be the result, or what sort of a hole would be made?

through the paper much less this kind. It appears that he forgot to look at the hole to see what sort of a one it was, otherwise he would have explained it better, therefore we will attempt to account for it more to our notion. We believe that each of these vessels had electricity in them, and that the one the Doctor thought full or positively charged, had a kind in it that we will call positive electricity, (we give it this name in honor of the Doctor's theory,) the other vessel, the one that he thought negatively charged, had a different kind in it, which we will for the same reason, call negative electricity. Now these two kinds attract each other with great force, as is proven by actual experiment, the result of which is that as soon as they are brought close to each other, the electricity of each will try to get together, for the positive electricity draws the negative to it, and it perforates the paper from that side in its passage over to the other vessel. Now the negative draws the positive to it also, and it in its passage through the paper bulges it out from that side, and thus the paper is perforated from both sides. To prove that these two kinds of electricity will not attract each

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What does Dr. Franklin's theory scarcely account for?—What is it that it does not account for?—What did he forget to examine in all probability?—What do we believe concerning this?—What kind do we believe that vessel had in it that the Doctor thought was positively charged?—What do we call the kind he had in the other vessel?—What do these two kinds of electricity do?

other unless you place the vessels in juxtaposition, you may take one in each hand, and gradually bring them close to each other, at which time you will feel the electricity pass through you, giving a shock, the intensity of which depends upon the quantity of electricity and the distance the vessels are apart. Now this proves that the arms and body are good conductors of electricity, and if there is but one kind of electricity, and that kind passes in search of an equilibrium from one place to another, and performs experiments as it passes, why would it not pass along the arms while the vessels are far apart as well as when they are near? We have proven that the arms are conductors of electricity, and of course (if it passes in search of an equilibrium with power enough to make a hole in paper,) it would pass along the arms when the vessels are at a distance as well as when they are close, for distance does not interfere with equilibrium, but does interfere materially with attraction. These are experiments that can easily be performed by any person who has an old-

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What is the result of this?—How will you prove that these two kinds of electricity will not attract each other unless they are placed near each other?—What will you feel passing through you? What does the electricity do to you while passing through?—What does the power of this shock depend upon?—What does this prove?—Does distance interfere with equilibrium?—What does attraction depend upon?—What is necessary in order to try these experiments?

fashioned electric machine and laten jars with moveable metallic coatings, by turning their machine until the inner coating of the laten jar becomes filled with positive electricity, which positive you know attracts negative to the outer coating of the laten jar from the air or the earth, if a chain be connected to it.

Now the glass prevents the positive electricity of the inside of the laten jar from attracting the negative to it, because it is a non-conductor, that is, it will not let it pass through it, but if you lift out the inside of the laten jar and hold it in one hand, you will find that the two kinds of electricity attract each other (provided you hold them close together, but not without) with great force, and as they pass along the arms, in and through them, you will experience a very singular sensation, called a shock, which lasts as long as the electricity is in motion, which is but an instant. Now this shock cannot be given any

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How may the experiment be performed?—What part of the laten jar becomes filled with positive electricity?—What does this positive do?—From whence does it obtain the negative electricity?—What office does the glass perform?—Why does it perform this office?—What do you mean by non-conductor?—What do you find on lifting out the inner coating of the latent jar and holding it in one hand and the other touching the outside with the other hand, holding your hands close together, and what is the result if you do not hold them near each other?—As it passes along the arms what do you experience?—How long does this shock last?

more until the laten jar is filled again in the same way. Therefore we are not able to obtain hard shocks in rapid succession from the electrical machine, but we may take ten thousand shocks from the galvanic battery in rapid succession, which is done by separating the two kinds of electricity, for they are always found together, and must be separated before any experiment of importance can be performed, at which time they will try to get together, and in so doing, they pass from one place to another, and as they are passing you may make them pass through you, at which time you will receive a shock.

Now, in order to separate these two kinds of electricity, and understand the *modus operandi*, it would be policy to investigate the means the Deity uses in separating them, for the purpose of creating thunder and lightning, because the more we know about his plan the easier and better can we do it ourselves.

What must be done in order to give another shock?—Can we obtain hard shocks in rapid succession by this machine?—What will give ten thousand shocks in rapid succession?—How is this done?—How are they always found?—What is always necessary in order to perform an experiment of importance?—What will they then try to do?—What does this effort to get together result in?—What would be policy in order to separate these two kinds of electricity understandingly?—Why is this policy?

SECTION II.

LESSON I.

THEORY OF LIGHTNING AND THUNDER.

The Deity, in order to separate the positive electricity from the negative, employs, in our humble opinion, an agent called oxygen, which attracts positive electricity, but repels negative. Now, whenever the Deity sees proper to have a body of positive electricity accumulated, he, in the first place, by the use of certain means, accumulates a body of oxygen, which attracts or draws the positive electricity. Now, what we want to know is, how the Deity accumulates the oxygen. We believe that he uses the oxygen that is about the surface of the earth, mostly that which is in the water, and in order to use the electricity that he separates by the oxygen, he wants it in the regions a little above the earth; therefore we believe he accumu-

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What does the Deity employ in separating the positive electricity from the negative?—What does oxygen do?—What does the Deity do in order to accumulate the positive electricity?—What does that oxygen do?—Now what is it that you want to learn in the first place?—From what source is the oxygen derived?—Where does the Deity want the electricity that he accumulates in order to use it?—Where is the oxygen gathered?

lates the oxygen in that region. But how does he carry the oxygen from the earth up there? Well, we cannot say that we know how he does it; but we can, like other philosophers, say what we think, and whether we are right or not, it will, we hope, answer the purpose for which thoughts are made, viz: the strengthening of the mind, and the acquiring of sufficient knowledge concerning these things to give us an ardent desire to understand them; so it matters not with us, so that we are just as near correct as we can get; nor it need not matter with others, unless they have better thoughts than we have, and then they will, of course, be kind enough to give them to us in exchange for ours: if they will, we shall not regret our trouble, because we prize a favor of this kind more than we do even their approbation, much less the approbation of any other class. So, with this understanding, we will give you our theory for the cause of this phenomena. The question before us is, how does the Deity carry the oxygen up to the aerial

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Do we profess to know how he carries the oxygen up to this region?—What can we do like other philosophers?—What do we hope in this respect?—What were thoughts intended for?—What matters not with us so that we are as near perfection as we can get?—Why should it matter with other philosophers?—If they have better thoughts on the subject than we have, what will they be expected to do?—What will be the result if they do this?—Why not regret our trouble?—Whose approbation do we prize the highest?—What is the question before us?

regions? In the first place, the power that holds the oxygen to the earth is removed, and then it goes up of its own accord. Now, what is this power, and how is it removed? In the first place it is called attraction, and it is the very same attraction that holds everything else to the earth; but in order to know how to remove it, we must know the cause of it. Here we will give our opinion, and in another lesson we will give the cause. We believe that this oxygen, as well as everything else, is held to the earth, because the positive electricity that is in it is attracted to the earth by the negative that is in the earth, and there is positive electricity mixed with the oxygen, which positive electricity is attracted forcibly to the earth by the negative electricity that always exists in the earth. Now recollect, that as the oxygen is with the positive electricity, it (the oxygen) would also be drawn to the earth, because the attraction between the oxygen and the positive electricity is so great that the positive electricity cannot be drawn to the earth without the oxygen going with it; therefore they stay together until something is done to separate them. This is what must be done in order to remove

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What power must be removed in the first place?—What does the oxygen do with its own accord when this power is removed?—What does this attraction of gravity do besides hold the oxygen to the surface of the earth?—What is our opinion?—What must we recollect?—How long will they stay together?

the force that holds the oxygen to the earth, because as soon as they are separated the oxygen is left free, or repelled from the earth by the negative electricity that is in it, which in all cases repels oxygen. But we want to know how the Deity separates this positive electricity from the oxygen. He does it by the heat of the sun, for a certain degree of heat will drive positive electricity from water without driving out the oxygen, and consequently leave the matter without much positive electricity, and hence that particle of water has no weight, for the positive electricity is driven out. (See Section V.)

You know from what has been said, that the weight of anything is caused by the positive electricity that is in the thing itself, being attracted by the negative electricity that is always in the earth on this side of the equator. Hence if the positive electricity is driven out of anything, that thing is no longer attracted to the earth, because there is no virtue in the earth to draw anything except positive electricity. Now, as it is plain that this particle of water (having no positive electricity in it) will weigh nothing, and hence it and the oxygen that is left in it, will rise up from the earth to

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What must be done?—What is it we want to know?—How does he separate the oxygen and positive electricity?—What will a certain degree of heat do?—How is the weight of a thing caused?—What is plain?

give place to the air that has positive electricity in it, for that air is held to the earth. Now this oxygen, as it goes up, would attract positive electricity to it from the adjacent particles of air through which it passes, were it not for the heat that yet remains in the particle of water, which heat will repel the positive electricity until the particle of water and oxygen have risen to a height that is in proportion to the intensity of the heat and the coldness of the region through which it passes. If the heat is sufficiently great, and the air not too cold, (which is usually the case in winter,) then the oxygen and water will reach a sufficient height, at which time the coldness of the atmosphere overpowers the heat of the particles of water, and then the oxygen attracts positive electricity from the air to it, and the particles of water will cease to rise higher, perhaps begin to descend, and as it remains still or descends, as the case may be, it meets with other particles of water ascending with only oxygen in them, the oxygen of which attracts the first particle of water, because of its positive electricity, for you know that the oxygen of the second particle of water will attract positive electricity as soon as it gets cold enough. As

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What will the oxygen do as it goes up?—What will the oxygen do if the heat is great?—What does it meet with?—Then what does the oxygen do?—Why?—When will the oxygen of the second particle of water begin to attract positive electricity?

it has to attract positive electricity from some source or other, it finds it as easy to get it from the first particle of water as from any other source, and in attracting the positive electricity of this particle of water, the two particles of water unite in one, and the oxygen is allowed to unite, and other particles rising up are also united upon the same principle, each affording a little oxygen until there is quite a collection. Now this oxygen, after it is sufficiently collected and all the heat neutralized by the coldness of this region, attracts a large body of positive electricity. This large body of positive electricity is in due time attracted back to the earth, because of the negative in the earth, and the cloud, as we may now call it, since so many particles of water are united. However, by chance, the air may gather under the cloud and resist its progress; if so, the negative in the earth may attract the positive in the cloud so powerfully, that the positive bursts forth from the cloud and goes on to the earth

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Where would it be as likely to find positive electricity with ease?—What is the result of attracting the positive electricity of this, the second, particle of water?—How are other particles united?—What does each afford, and what is the result?—And what does this large body of oxygen do after the heat has been neutralized in this cold region?—What becomes of this large body of positive electricity?—Now what may these particles of water be called after they unite in this way?—What becomes of this cloud?—What may happen by chance?—If so, what will the negative electricity in the earth do?

by itself, at which time it gives a brilliant light, called lightning. It also makes a tremendous noise, called thunder, because in passing through the air it splits it, and the air on coming together is thrown into a vibratory motion, which causes it to play upon the ear-drum (if there is such a thing in the area of vibrating air) and produces sound.

And if so, what will the positive in the cloud do?—What does it give on passing through the transparent air?—It also does what?—What is this noise called?—Why does it make a noise?

SECTION III.

LESSON I.

HOW TO CHARGE THE GALVANIC BATTERY.

Having treated of what we suppose to be the means the Deity uses for separating these two kinds of electricity for the purpose of creating lightning and thunder, we will invite the reader's attention in the present lesson to the means we must use for the purpose of separating the positive electricity from the negative, that we may use it in trying various experiments. We also purpose in the next lesson to give our opinion of the cause of the formation and duration of a current of electricity, and why it is that so many experiments can be performed with it while the electricity is in motion.

In the first place, you must know that electricity is not capable of performing any important experiment until it is put in motion by some means or other. To set it in such a motion as is necessary to perform experiments requiring much power, we must separate our two kinds of electricity and place

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To what is the reader's attention invited first?—What do we propose next?—What must you know in the first place?—What must we do in order to set it in such a motion as will enable us to perform experiments requiring considerable power?

them close together, so that they can attract each other. This may be done in several ways. We purpose inviting your attention to a plan much used by electricians. It consists in the use of two kinds of metals, one of which must be more easy of oxydation than the other—for instance, zinc and copper. The zinc having a stronger attraction for oxygen than the copper is more easy of oxydation; that is, if you place zinc in an acid where there is oxygen, the oxygen will be attracted by the zinc until there is a thin stratum of oxygen formed all over its surface, or at least over that portion of its surface which is immersed in the acid. Here we may state that blue vitriol, dissolved in water, forms perhaps the best acid. Make the solution just half as strong as it will make itself by dissolving the blue vitriol; that is, let the water dissolve half as much blue vitriol as it will. For observation teaches us that an acid of this strength is better than a stronger or weaker one. The reason why this zinc attracts the oxygen is because zinc is full of positive electricity; at least it has more positive than negative.

Why do we want them placed close together?—Is there more than one way to do this?—What does the plan to which your attention is invited consist in?—Are they to be alike?—What metals are often used?—Which is the easiest of oxydation?—Why?—What will be the result if you place zinc in an acid where there is oxygen?—What forms a good acid for the purpose?—How strong should the blue vitriol be?—Why does the zinc attract the oxygen?

This positive attracts the oxygen, and that is the same as the zinc attracting it. If you could take all the positive electricity out of the zinc, then it would not attract the oxygen; but we never had all the positive electricity out of it, nor never will, for the positive electricity is essential to its existence, it being made partially of positive electricity. The copper is made partially of positive electricity also, but has not near so much in it as the zinc; therefore, it does not attract the oxygen so much as the zinc, and that is the reason why it is more easy of oxydation.

In order to use the zinc and copper in separating the positive and negative electricities, take an open cylinder of zinc and place it between two closed cylinders of copper, so that they be within about one-fourth of an inch of each other, but do not let them touch. You may prevent this by fitting a piece of wood or glass firmly in the upper end of the zinc cylinder, with a little groove in the lower end of it for the inner copper cylinder to rest in.

What would be the result of taking out all the positive electricity were you able to do it?—What is essential to the existence of zinc?—What is the copper made of?—Has it as much in it as zinc?—Why does it not attract as much oxygen?—Then why is the zinc more easy of oxydation?—What shape is convenient to have the zinc?—Where must you place the zinc?—How near each other?—Must they touch?—How can you prevent it?—What should be in the lower end of the wood or glass?—What should rest in this groove?

This piece of wood or glass resting upon the inner copper cylinder will support the zinc and prevent it from touching the copper. For convenience sake you may have a handle attached to the upper end of the piece of wood or glass, in order to handle the zinc. Having prepared the zinc and copper in this way, pour the acid in the copper vessel around the zinc, until it is two-thirds full. The zinc will then attract a certain portion of the oxygen to its surface as above stated. This oxygen being held on the surface of the zinc, will gradually mix with the particles of zinc immediately exposed to it, because the positive electricity of those particles and the oxygen attract each other, and in so doing the zinc is oxydized, and hence the electricity of those particles of zinc is developed.

This electricity is of two kinds—negative and positive, and there is no affinity between the negative and oxygen, hence they will not stay together, but must separate. In fact the oxygen repels the negative to the copper, it being on either side of the zinc, and in this way the copper becomes charged with negative electricity. The oxygen holds on to

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What should be supported in this way?—What may be attached to the upper end of the wood or glass?—What must you do next?—How full should it be?—What will the zinc do?—What will this oxygen do, and why?—How many kinds of electricity are developed?—Is there any affinity between negative electricity and oxygen?—What are they bound to do?—What does the oxygen do?

the positive electricity, and hence the zinc is charged with positive. This positive would attract the negative to it were it not that the oxygen repels it, and the negative cannot attract the positive to it, because the oxygen will not let it leave the surface of the zinc; hence they are separated, and remain so until a road is made for the negative to travel upon to the positive electricity, without going through the stratum of oxygen. This may be done by connecting the zinc and copper with a wire, at which instant the positive attracts the negative to it through the wire. The reason why the negative does not attract the positive through the wire to it is because the oxygen holds on too forcibly to it, and also because the negative is allowed to pass into the wire in search of an equilibrium as soon as it is connected to the copper, and is brought close to the positive by connecting the wire to the zinc, and is therefore attracted with the more force, for attraction increases as distance decreases. When the negative is thus brought close to the oxygen, which you know must

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How does the copper become charged?—What does the oxygen do to the positive?—How does the zinc become charged?—What prevents this positive from attracting the negative back through the acid to it again?—Then why does not the negative attract the positive through the acid to it?—Why will not the oxygen let it leave the zinc?—What must be done that they may attract each other?—Why?—How may this be done?—What is attraction proportionate to?—What does the oxygen do next?

be the case, as the positive electricity attracts the negative to it, (it being with the oxygen,) the oxygen employs the same force in repelling it that it employed in attracting the positive; and therefore the positive is no longer held on the surface of the zinc, but passes off through the acid to the copper in search of an equilibrium, and thence into the wire that connects the zinc and copper, and is attracted with much force into the zinc, both by the negative electricity and the oxygen, insomuch that it displaces (owing to impenetrability) the negative, or drives it by the stratum of oxygen, at which time it is instantly repelled back to the copper, where it was at the start, and passes in search of an equilibrium into the wire, and therefore is attracted to the zinc again as it was before. The positive passing from the surface of the zinc (because of reasons already given) to the copper, and thence into the wire, being attracted forcibly to the zinc as before, for reasons above given. Thus the two kinds of electricity continue to exert a surprising power over each other in their efforts to get together, from the fact that oxygen, by repelling one kind and attracting the other, prevents their coming together. Now this power is used in various ways already, and will no

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What does the positive do?—By what?—Then what does it do?—Where does the positive then go?—What do the two kinds of electricity continue to do?—Why?—And what does this result in forming?

doubt in the course of time be used to great advantage as a motive power, for there can be no doubt but what the time is coming when motive power will be more valuable, and the means of generating more costly if we depend upon fuel; but in our humble opinion, the Deity foreseeing this event, has placed within our reach invisible means of acquiring power from an inexhaustible source, and that if developments in this science keep pace with our necessities, as they have so far, they will in the course of time draw aside the veil that hides these means from our view.

How will this power be used in the course of time?—What will be the supposed result of depending upon fuel as a motive power?—What is our humble opinion?

LESSON II.

THE FORMATION AND CAUSE OF THE CONTINUATION OF A CURRENT OF ELECTRICITY.

If this current of electricity, or, as it is sometimes called, galvanism, (in honor of Professor Galvani, an Italian philosopher, whose investigation of an accidental experiment made by one of his students, terminated in this discovery,) is passed around a piece of soft iron, it fills it with electricity, because the positive electricity in the iron attracts the negative that goes around it. Recollect, the negative goes through the wire first, and of course around the iron first, and that both kinds of electricity exist in every piece of iron. The positive of this piece of iron attracts the negative of the current so as to hold some of it on its surface, and the positive spark of electricity that goes around the iron through the wire next attracts this negative to the end that it goes around first, and in so doing fills that end with negative electricity, because in passing around the iron it attracts the negative towards it, the negative being on every side; and the positive, as it passes

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What is this current of electricity sometimes called, and why? What is the result of passing this current of galvanism around a piece of soft iron?—Why does it fill it with electricity?—What must we recollect?—What does the positive do?—What does the positive spark that goes through the wire next do?—Why?

from one side to the other, attracts that negative towards it that happens to be on the opposite side, and consequently in the iron. The negative spark will pass through the wire next, and on going around this end will drive the negative that is already in the iron still further in, because negative pushes negative as forcibly as positive attracts negative. Were there just as much negative electricity in the iron as positive, it would (like most substances) never become charged with electricity by passing a current around it, because the negative in the iron would then repel the negative that passed around it as forcibly as the positive attracted it, and therefore no negative would be left on the surface of the iron for the positive spark to attract. When the first end of the iron becomes charged with negative electricity it will attract another piece of iron to it, because the negative electricity of it will attract the positive electricity of anything, and if it is a thing that has much positive in it, and if it holds on to that positive with as much tenacity as iron does, the thing itself will be drawn in the act of drawing the positive electricity that is in it.

What does the negative spark do when it goes through the wire again?—Why?—What would be the result were there just as much negative electricity in the iron as positive?—Why?—When the first end of the iron becomes charged with negative electricity, what will it do?—Why?—What if it is a thing that holds on to its positive electricity?

Now the last end of the piece of iron around which the current goes will become charged with positive electricity, because some of the positive spark that goes around the iron is held to the surface of the iron by the negative that was first deposited in the iron, as above stated. This positive is attracted by the next negative spark that goes around the iron, and as it carries it along the iron toward the last end, it attracts it into it, because in going around the iron so often it has time to draw that positive into the iron that happens to be on the opposite side; and therefore this end of the piece of iron becomes a magnet also, and will attract anything to it that has negative electricity in it, provided that thing will hold on tightly to its electricity.

If you take the blade of a knife, or any other piece of steel containing edge-tool temper, and draw it across either end of this magnet, the electricity will pass out of the magnet and go to the steel. This it does in search of an equilibrium, and the steel will become charged with the kind of electricity that is in the end of the iron upon which the steel is drawn. This electricity will attract elec-

What will the last end of the iron around which the current goes become charged with?—Why?—What is this positive attracted by?—What does this negative spark do as it carries the positive with it along the surface of the last end of the iron around which the current is passing?—Why?—What will be the result of drawing the blade of your knife from heel to point across the end of this magnet?—Why does it do this?

tricity of the opposite kind, and as all iron has both kinds of electricity, of course this steel will attract any piece of natural iron, but if the piece of iron is unnaturally charged with electricity of the same kind, then the steel will repel the iron, for like kinds repel each other—negative repels negative—positive repels positive; but positive attracts negative, and negative attracts positive. If proof be required, draw two pieces of steel across the same end of the magnet, and they will of course have the same kind of electricity; balance one of the pieces on a pivot, so as to move easily, take the other and try to touch the ends of each together; you will find that they repel each other, insomuch that you cannot touch them. This proves that negative repels negative, or if the pieces of steel have been drawn upon the positive pole of the magnet, it proves that positive repels positive. If one of them be drawn across the negative, and the other across the positive, you find that they attract each other.

This proves that there are two kinds of electricity; for it is the electricity itself that causes the attraction and repulsion, and not the want of it in one case and its presence in the other, as was supposed by Dr. Franklin. Perhaps our readers will object to calling into question this time-honored theory of

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What will this electricity do?—What do like kinds of electricity do?—How is this proven?—What do you say this proves?

Dr. Franklin's in his absence, therefore we will invite the Doctor to honor us with his posthumous presence, which perhaps will not be refused, because, if we understand him correctly, he said that it would give him great pleasure to visit the earth some future time, and revel amidst the improvements, marking the contrast between the two periods. Who will deny but what he will consent to visit us, and thereby, to some extent, reap the reward of his labor, for we are sure that realizing his anticipations would be happiness to him? Therefore, O Dr. Franklin, if you can condescend to leave the realms of bliss and visit the improvements you, through your efforts and your great wisdom and philosophy, set in motion, do honor us with your imaginary presence for one moment, while we, with due reverence and humility, call into question one of your immortal theories, and try to substitute one in the place of it that coincides better with our limited knowledge. Having invited the Doctor's posthumous presence, you will perhaps take no exception to our debating the subject, no matter if we do differ with the Doctor a little, it will not be the first time ever one great man differed with another. In fact differences should exist in the right spirit, for they afford whole-

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How do you prove that there are two kinds of electricity?—What causes the attraction and repulsion?—What did Dr. Franklin suppose it was?—What did Dr. Franklin say would give him pleasure?

some stimulants for investigation. Then we will commence our debate; but we doubt the Doctor's taking issue with so able a debater as we are, for we believe he has already been convinced of his error in this respect.

Why should the mere charging of the two pieces of steel with less than a natural quantity, cause them to repel each other, when they are charged exactly alike; that is, just as much taken from one as the other, which must of course be the case;—or, according to his own theory, they would attract each other instead of repelling. The reason of their attracting each other could be accounted for by his theory upon the principle of the electricity seeking an equilibrium; for it is true that the electricity of one piece having but a little more than the other, would try to get with the piece that has a little less in it, in order to share what it has with its neighbor. But when they have precisely equal quantities (as must be the case, according to his theory, in order to prevent attraction,) we cannot see why they do not remain still, without pushing or attracting, for they certainly have an equilibrium; and hence no pushing it off or attracting it to it, for they are, according to both theories, just as if they had not been charged at all: for what you put in

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When are they the same as not charged?—When one of two pieces of iron have been rubbed upon a good magnet, and the other upon a bad one, what is the result?

one you also put in the other, and hence they bear the same relation to each other as they did before drawing them across the magnet. Admit, for argument sake, that they would repel each other, provided they had exactly like quantities of electricity; or, if it suits better, admit that they would repel each other, provided there was none at all in either piece. First, admit the same quantity in each would repel—how is it that they become charged exactly alike in every instance, particularly when you draw one of them across a good strong magnet, and the other across a weak one? We know that in this case one piece will lift up twice as large a piece of iron as the other, and yet these two magnets or pieces of steel being of the same size are charged just alike—are they—because they repel each other?

Admitting, as we promised, that if the two pieces of steel had no electricity in them at all, they would repel each other, the same difficulty would remain, from the fact, that one of the pieces attracts more of the same iron than the other. We cannot understand this difficulty. We shall believe that one piece of the steel has the same kind in it as the other, and that the two like kinds repel each other, no matter if one has more than the other, so it has

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Then do you think that they are charged just alike because they repel each other?—Admitting that there is no electricity at all in them, what difficulty would exist, and why?

the same kind. For in every instance, if they are drawn upon the same end they will repel; but if they are rubbed upon different ends, they will attract, because positive attracts negative, and positive repels positive—negative attracts positive, and negative repels negative.

Can you reconcile yourself to this difficulty?—If not, on what must we believe?—If they are drawn upon the same end, what will they do?—If upon different ends what will they do?—And why?

SECTION IV.

LESSON I.

TEMPORARY MAGNET.—TELEGRAPH.

We have already stated that when a current is passed around a piece of soft iron that it fills it with electricity. This electricity will draw the electricity of a common piece of iron to it, and in so doing it of course draws the iron; for instance, we take a piece of round iron, say six inches long and half an inch in diameter, and bend it in the shape of the letter U, bringing the ends within an inch of each other, then wrap each end with insulated copper wire, (that is wire wrapped closely with thread,) commencing about three feet from the end, and wrapping it closely around one end of the iron until two inches of it is covered completely, then wrap it around the iron again closely all over the same wrapping, and repeat until these two inches of the iron are covered four times. Then take your wire around the iron once or twice to within two inches of the other end; wrap this end as you did the other, cut off the wire three feet from the magnet. Touch

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What have we already stated?—What is meant by insulated wire?—How do you make a temporary magnet?—How long will this temporary magnet hold a piece of iron?

these two ends of the wire to a galvanic battery, and a current of electricity will pass through the wire around the iron as often as you have coiled the wire around it; provided the wire does not touch itself, which of course the insulation prevented. This current will fill the iron with electricity, at which time the iron becomes what is called a temporary magnet, and will draw another piece of iron with considerable force, and hold it there as long as the wire is touching the battery.

Take a piece of iron two inches long, one-fourth wide, and one-third thick, place this piece of iron, which we will call an armature, within one-fourth of an inch of the end of the iron wrapped with wire, and fasten it in some way so as to leave it easy to move towards the magnet when the current is passed around it through the wire, but so that it will, with its own accord, leave the magnet as soon as the current ceases to pass around it. By having it fastened in this way you can touch the wire to the battery when you please, and the current will pass from the battery through the wire to the magnet, and around the magnet along the wire to the zinc; then will the magnet draw the iron armature to it and hold it there until one end of the wire is taken from the battery, at which time the current ceases

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How may an armature be fixed to this magnet?—What is necessary in order to make the magnet attract the armature?—What takes place when the wires are touched to the battery?

to flow, and the iron is no longer a magnet and cannot hold the armature to it; therefore it moves back from the magnet to a distance of one-fourth of an inch, it being fixed so as to move from the magnet as soon as the power that draws it is removed. But if you touch the wire again to the battery the electricity will pass into the magnet and draw the iron or armature to it again, and hold it there until the wire is taken off. This it will do every time you touch the wire to the battery, no matter how far the magnet is from it, provided the wires reaches to it; for the electricity will pass the whole distance through the wire to the magnet, and make it pull the iron down to it, at which time it will strike against the magnet and produce a sound enabling us to use it by way of giving signals. Let it strike once, for instance, for the sign *yes*, which you make it do by touching the wires to the battery once; or twice, for the sign *no*. Suppose you have a friend at a distance, and he has a magnet of this kind with wires reaching to you, he can touch them to a battery when he pleases, and make signs to you by having an understanding concerning those signs. For instance, your understanding is for him to touch the wire once to the battery to make the iron strike the magnet once for the sign E, twice for the sign

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Then what does the armature do?—How may this be used?—How can you make the sign for yes?—How for the sign no?—How may signs be made to a friend at a distance?

J, three times for C, four times for S, and let the wire stay on the magnet a little while for the letter T, then make two T's for the letter M, or one E and one T for O, or one T and one E for H, and so on for the whole alphabet. By having this agreement, you can at any time spell out any word you please. This is strictly telegraphing news from one place to another.

How may you spell out any word?—What is this strictly called?

LESSON II.

CIRCULAR MOTION.—HORSE-SHOE MAGNET.—SUSPENSION OF A BAR OF IRON.

If you take a piece of steel, say eight inches long, and bend it in the shape of the letter U, and charge it heavily with negative electricity in one end, and positive in the other, which you can do by drawing one end on the positive pole of a piece of soft iron that is wrapped with wire, through which a current of electricity is passing, and the other end upon the negative pole. In order to draw it upon the magnet you must lay the steel upon the magnet, and draw it towards the end of the steel, then lift it up and lay it on again about four inches from the end of the steel, drawing it across toward the end again. Do this several times and the end will be charged with negative electricity, if you have been drawing it across the negative end of the magnet. Take the other end of the iron and draw it in the same way upon the other end of the magnet. The steel is then charged with electricity, and will attract a piece

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How may a piece of steel be charged heavily with electricity after it is shaped like the letter U?—What is this kind of a magnet called?—How may a temporary magnet be made to revolve between the poles of a horse-shoe magnet?

of iron to it and hold it there. This is called the horse-shoe magnet.

Fix a piece of soft iron between the two ends of the horse-shoe magnet, so it can revolve without touching, and yet be very close to it, and have this piece of iron wrapped with insulated copper wire so that you can pass a current of electricity around it, first from one end to the other, and *vice versa*, as it changes its position by revolving. This makes it become a temporary magnet, first one end charged with negative and then with positive, as it changes its position. By turning the little piece of iron half around and touching the wires that it is wrapped with to the battery, the current will pass around one end of the iron first, and make that end become charged with negative electricity, and the end of the horse-shoe magnet that is charged with positive will attract it, and at the same time the other end will repel it; this makes it begin to revolve. The other end of the magnet will be charged with positive, because the current is last going around it. The other end of the horse-shoe magnet that is charged with negative will draw this end to it, and at the same time the other end will repel it. So the same end is pushed by the nega-

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How is the first end of the magnet around which the current goes charged?—How is the last end charged?—Why?—Which end will the negative pole of the horse-shoe magnet attract?—What does it do at the same time?

tive pole of the horse-shoe magnet that is attracted by the positive pole; hence they aid each other in making the little magnet or armature revolve, and therefore it will revolve half around. At which time the current passes around this end and is attracted and pushed just like the other end was, until it turns entirely around, and thus it keeps on turning as long as the battery is charged. This forms circular motion, which may be, and no doubt will be in the course of time, communicated to wheels of the largest size by the aid of machinery, so as to make them revolve, if the current is made strong by a large battery. We have no doubt but what the Deity created this principle for this and similar purposes; depriving us of the use of it, through good motives, until we become acquainted with it. And what do you suppose these motives are? Is it simply that man should be compelled to work the more until they "get knowledge and understanding," or because he knew, through his infinite wisdom, that man would endanger their lives in the very act of using it, unless they first became acquainted with the principles by which it is done.

Which end is attracted by the positive pole?—What will the little armature do?—What does the current then do?—How long will it continue to revolve?—What does this form?—What is supposed concerning the Deity?—What may this motion be communicated to if a larger battery is used?—What is there no doubt about?

Another very beautiful experiment may be performed with a current of electricity. Take a piece of soft round iron about six inches long, and about three-eighths of an inch in diameter, and wrap tightly about four inches of it about eight times thick with insulated copper wire; then drive the piece of iron out of the coil of wire. By making one end a little less than the other you will be enabled to drive it out without much difficulty. This leaves the coil of wire with an opening within it. Pass a current of electricity through this wire, and place a smaller rod of iron in the opening, say one-eighth of an inch in diameter and two or three inches long, according to the strength of your battery, the current of electricity going through the wire will attract it in every direction, so that it will hang in the opening without touching the wire. The reason of this is the positive electricity of the current attracts the negative electricity of the iron, and in so doing the iron itself is attracted. This enables you to suspend a bar of iron in the air without touching any thing, and proves that electricity itself is attraction, and as there are two kinds of attraction, there must be two kinds of electricity.

What other beautiful experiment may be performed with a current of electricity, and how will you prepare for it?—What is the cause of this?—What does this enable you to do?—What does it prove?

SECTION V.

LESSON I.

VARIATION OF THE MAGNETIC NEEDLE.

Take a piece of iron about five inches long and one-fourth of an inch in diameter, and place it in a coil of wire, through which a current of electricity is passing, and it will become charged. The end around which the current first passes will be charged with negative, the other with positive, forming a temporary magnet. By fixing a pivot on a slide, so that it can be moved from one end to the other easily, and having a magnetic needle on the pivot, and sliding it from one end to the other, you will find that one end of the needle will be attracted to the magnet, the other end pushed from it. The reason of this is, that one end of the magnet has positive electricity in it, and one end of the magnetic needle has negative in it, and the positive end of the magnet attracts the negative end of the needle Place the needle in the centre of the magnet, and

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How may a temperary magnet be made in order to try its influence upon a magnetic needle?—What do we observe on sliding the needle from one end to the other?—What is the reason of this?—What do you observe on placing the needle in the centre of the magnet?

the positive end of the magnet will attract the negative of the needle just as much as the negative end of the magnet attracts the positive end of the needle, so the needle has no dip when placed in the centre or equator of the magnet; but if we move it toward the south end of the magnet, (we will call the positive pole of the magnet the south end, and the negative pole the north end,) it will be attracted by the south pole of the magnet, it being the pole that has positive electricity in it, and the nearer you take it to the south pole the stronger it will be attracted; but if you move it back, the moment you cross the equator of the magnet, that is the centre, then the north pole of the needle, that is the end that has positive electricity in it, will be attracted by the north pole of the magnet, that is the end that has negative electricity in it, and the nearer you take it to the north end the more it will be attracted. This is exactly the case with the magnetic needle and the earth, it being the same kind of a magnet that the piece of iron is, because there is negative electricity in the earth on this side of the equator, just like the north pole of the magnet, the end the current goes around first; and positive in the earth south of the equator, just the same as in

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Which end of the magnet do we call the positive, which the negative?—What is the result of crossing the equator?—What effect has the earth on the magnetic needle?

the south pole of the magnet, the positive end.—Hence a common piece of iron is attracted by the earth on either side of the equator, if it is not unnaturally charged; but if it is, it will be treated just like the earth treats the magnetic needle, because the magnetic needle is nothing more than an unnatural piece of iron, it being charged in one end with positive and in the other with negative, balanced on a pivot so as to move easily, at which time it turns the end that has positive electricity in it towards the north pole. A current of electricity will make a magnetic needle stand at right angles to it, because the negative spark of a current of electricity passing along a wire near a magnetic needle will push the end of the needle that has negative electricity in it as far from it as it can, for negative pushes negative, and by the time it has pushed it off it will have passed through the wire by the needle, and the positive spark in following the negative will be opposite the needle, and will attract the same end of the needle that the negative repelled; but before the needle has time to come to it the positive spark will pass it on its way through the wire, and the negative will be opposite the needle and repel it again, so the negative repels

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Is a common piece of iron attracted on both sides of the equator alike?—Upon what principle?—Suppose the iron is unnaturally charged?—What is a magnetic needle?—What does it do, and why?

this end of the needle as much as the positive attracts it—consequently the needle in obedience to the laws of motion will be obliged to take a position between the two forces at an equal distance from each; this of course makes it stand at right angles, and this is the reason why a current of electricity makes a needle stand across it. It is no longer difficult to account for the needle standing north and south when it is balanced upon a pivot so as to move easily. For a current of electricity passes around the earth from east to west, and has the same effect on the magnetic needle as the current passing through the wire, only it is not so powerful, because it does not go around the earth so fast; but it is powerful enough to make the needle stand at right angles to it, which would be north and south. This current must be composed of both kinds of electricity, because the earth has both kinds in it. It sometimes happens that the needle does not stand exactly at right angles to this current; this gives the needle what is or may be called an irregular variation, and is caused by the negative spark of this current of electricity repelling the positive of the north pole of the magnetic needle with more force than the positive spark attracts it, as might easily be the

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This being the case, what is no longer difficult to do?—Why?—What effect does this current have on the magnetic needle?—What is it powerful enough to do?—How many kinds of electricity is this current composed of?

case should the earth be so wet as to afford the negative electricity of its interior free access to its surface, (water being a good conductor,) causing the negative to exist in great abundance about its surface. Observation proves that as wet countries become dry the needle takes its proper place.

What does sometimes happen?—What does this give?—How is it caused?—What does observation prove?

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LESSON II.

ATTRACTION OF GRAVITY AND COHESIVE ATTRACTION.

I informed you on page 46 that a piece of iron, around which a current of electricity is passing, becomes the same kind of a magnet that the earth is, and therefore would attract every thing to it just like the earth were it as large a magnet. But as it is not, it cannot attract such things as give up that portion of electricity that is in their pores easily, as does almost every thing except iron. This is because the electricity that it draws comes out of it before it is attracted as hard as the earth attracts the electricity that the thing is made of, because the earth is a more powerful magnet, and therefore attracts the electricity that the thing is made of, and this iron is only powerful enough to attract the electricity that is in its pores, and hence cannot draw any thing to it unless it is such things as hold on tightly to the electricity that is in their pores; and there is nothing except iron porous enough to admit sufficient electricity for this purpose, except it is such substances as do not hold on tightly to the electricity

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What sort of a magnet is the iron?—Then why does it not attract every thing to it like the earth?—Does it attract such things as give up easily the electricity that is in their pores, and why?

of their pores. For instance, cotton, wood, feathers, &c., which substances are attracted by the earth with more force than is essential in order to draw all the electricity out of their pores, because the earth is powerful enough to attract that portion of electricity that these substances are made of, and as that electricity cannot be attracted out of them without a greater force than is essential to the drawing of the substance itself. Therefore the thing itself is drawn through the air to the earth. This is all the difference there is in these two magnets, as is also indubitably proven by the influence of each upon the magnetic needle. Therefore is it not reasonable to suppose that the Deity makes this earth magnetic by passing a current around it, similar to the one we pass around the iron, in order to make it a magnet; which he does by giving the earth a motion upon its axis from west to east, and inasmuch as the electricity that is in the pores of the earth, and not the electricity that it is made of, does not partake of this motion, it of course has a motion with reference to the earth from east to west,

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Why are such things as feathers, wood, &c., &c., that give up easily the electricity of their pores, attracted by the earth, and not by this temporary magnet?—What is the only difference in these two magnets?—How is this proven?—What is it reasonable to suppose?—How does he make it become a magnet?—Does the electricity that is in the pores of the earth partake of this motion?—What then is the result?

and consequently passes around the earth from east to west as fast as the earth turns from west to east, similar to the current passing around the iron; which is consistent with the laws that govern fluids, as we are led to believe by observation. The water in a vessel will not partake of the motion of the vessel, as is proven by taking a glass of water in your hand and sprinkling a few particles of bran on its surface; after the water becomes still in the glass, turn it around with a steady hand, and you will find that the bran does not move around with the glass, and consequently the water does not. This proves that the fluid does not partake of the motion of the vessel; and hence, according to this principle, the electricity would not move around with the earth as it turns upon its axis, and therefore it is always moving with reference to the earth from east to west, with the same velocity that the earth does from west to east, and consequently has the same influence upon the earth that the current has upon the iron, which is nothing more than charging the earth on this side of the equator with negative electricity, like the current does that end of the iron around which it passes. See page 45. It is true that this

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How fast does the electricity of the earth move from east to west?—What is this motion of the electricity around the earth similar to?—What is this consistent with?—Will water in a vessel partake of the same motion that the vessel does?—How is this proven?—What influence must this electricity have upon the earth?

current does not go around the earth as fast as the current goes around the piece of iron, for it is said to travel around the iron through the wire at the rate of 180,000 miles per second, whereas it only travels around the earth at the equator with the velocity of one thousand miles per hour. This explains the reason why so much difference exists in the strength of the two magnets, in proportion to their size, or the matter contained in them. If this current could go around the earth as fast as it does around the iron, it would make the earth a magnet 648,000 times stronger than it is; but the earth would have to revolve upon its axis 648,000 times faster than it now does, and the faster it turns the greater would be its centrifugal force, though not sufficiently so to counteract the gravity, from the fact that the current of electricity produced by the motion of the earth creates a magnetic power that is greater than the centrifugal force produced by its motion, or else we would have no attraction of gra-

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How fast does this current go around the earth?—How fast does the current go around the iron?—How fast does it go around the earth at the equator?—What does this explain?—Which is the strongest magnet in proportion to size?—If the current went around the earth as fast as it does the iron, what effect would it have upon the earth?—What would have to take place first?—What effect upon the centrifugal force of the earth?—What does the current of electricity produced by the motion of the earth create?—What would be the result if it did not?—What is meant then by centrifugal force?

vity, for every thing would be thrown off from the earth with as much force as they are attracted. The negative electricity in the earth on this side of the equator attracts the positive electricity of every thing that is near its surface, and in so doing it draws the substance itself to it, because it cannot draw the positive electricity without, from the fact that it requires a greater force to draw the positive electricity to it than is essential in order to draw the substance itself. The positive electricity of the earth on the other side of the equator draws the negative electricity of every thing to it upon the same principle, and as every thing possesses both kinds of electricity, therefore they are attracted on either side of the equator. On this side, because of the positive electricity, and on the other side, because of the negative, similar to this piece of iron. We have already said that either end of the iron attracts the same piece of iron ; that is, the negative in one end of the iron attracts the positive of another piece, and the positive in the other end attracts the negative of the same piece of iron. We verily believe, therefore, that the attraction of gravity is created in this way, and that by taking all the positive electri-

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What does the negative electricity in the earth do ?—Why does it draw the substance itself to it?—What does the positive electricity in the earth on the other side of the equator do ?—Why is the same thing attracted on either side of the equator of the earth ? What have we already said ?—What do we verily believe ?

city out of any substance, it would loose its gravity on this side of the equator, and that by taking all the negative out, it would loose its weight on the other side.

We cannot take the electricity out of a substance without destroying its cohesive attraction. By cohesive attraction, we mean the power that holds the particles of which the thing is composed together. Cohesive attraction is created by electricity upon the following principle :—One particle of the substance having positive electricity in it, and the particle adjoining it negative, these particles being very near each other, the electricity of one attracts that of the other, and therefore the two particles are held together, because these two kinds of electricity cannot be easily separated, they being so very close to each other, and therefore attract each other with great power, because the two kinds of electricity constitute a portion or the whole of the matter itself, at least being essential to the existence of the substance, therefore the particles themselves are held together with as much force as the negative and positive exert over each other.

What would be the result of taking all the positive electricity out of any thing, and what the negative?—What do we destroy by taking all the electricity out of any thing?—What do we mean by cohesive attraction?—Relate the principle?—What do these two kinds of electricity constitute?—With what force are the particles themselves held together?